A First Look at PTR-MS and AMS Observations from the Aldine Site of the Houston Triangle

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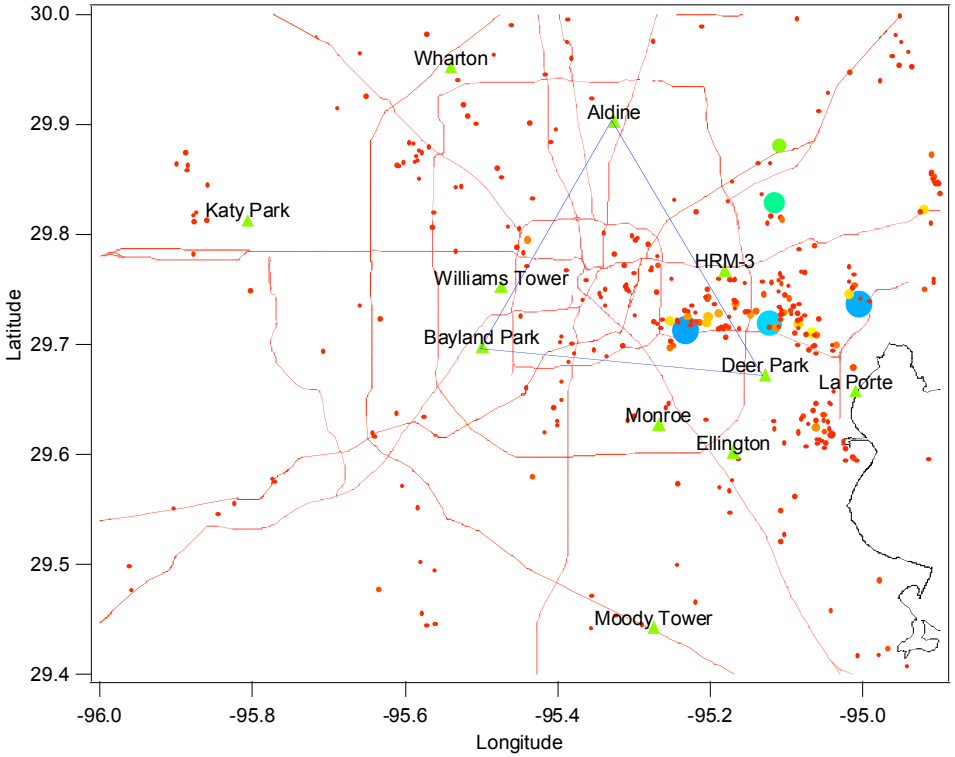
Overview of the Houston Triangle



Sampling period

- PTR-MS
  9/13/06 - 9/28/06
- AMS
  9/15/06 -9/28/06

Research Objectives

- Conversion and interaction between VOCs and SOAs
- Better understanding of SOA formation
- VOCs and aerosol characterization
- VOCs and aerosol emission sources

Previous Findings in Aldine

- What did we know? Why did we choose Aldine?
  - EPA Houston Supersite research highlights led by Dave Allen & Matt Fraser
    - Overview of major findings in the Houston Supersite, in press, Allen & Fraser, J. Air & Waste Management Association, 2006
    - Size distribution of organic functional groups in ambient aerosols, La Porte – HRM-3 - Aldine, Russell & Allen, AST, 2004
    - Polar organic compounds in fine PM, La Porte – HRM-3 – Aldine, Fraser, Atm. Environ., 2004
    - Predicting SOA formation due to rxns of aromatics and monoterpenes, Allen, JGR, 2005
    - Seasonal and spatial OCEC in Houston, Russell & Allen, Atm. Environ, 2004
    - Fine particulate matter Supersites program, Solomon & Allen, AST, 2004
    - Plus many other papers
  - Aerosol hygroscopicity by Don Collins' group in Aldine in 2002, Atm. Enviorn.,2004, only aerosol size and hydroscopicity were measured
  - Most recent pub SOA contribution on aerosol formation, Fan et al., GRL, 2006
- Why is data set unique?
  - Make simultaneous PTR-MS and AMS measurements
  - Learn more about gas-to-particle conversion and interaction.

Field Site & Instrumentation at Aldine

Trailer seen from the TCEQ monitoring station at Aldine

Texas A & M University PTR-MS

- PTR-MS (Texas A&M)

20+ species, 2 min resolution

- AMS (PNNL/EMSL)

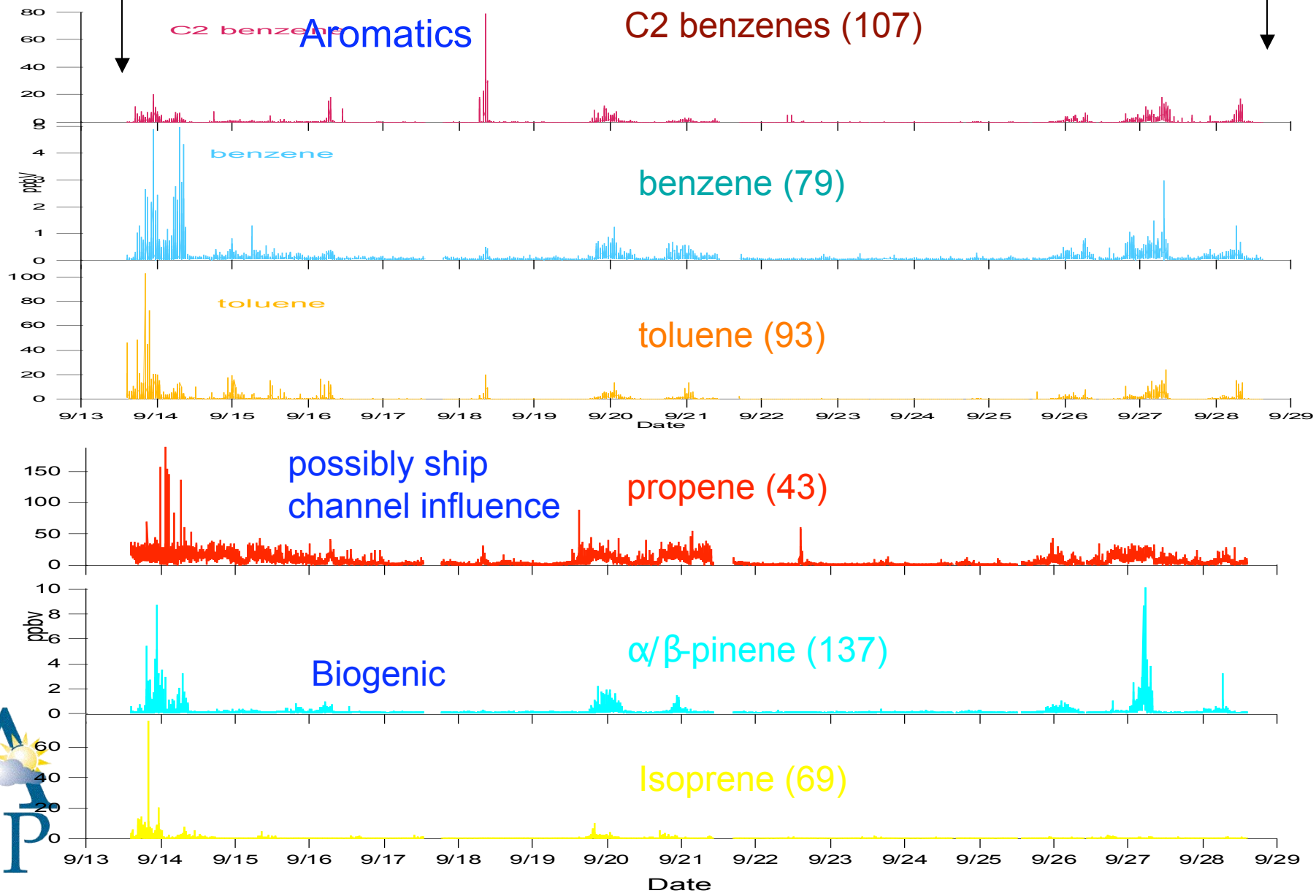
Org, SO_4, NO_3, Cl, NH_4, 5 min data

PNNL/EMSL c-ToF AMS

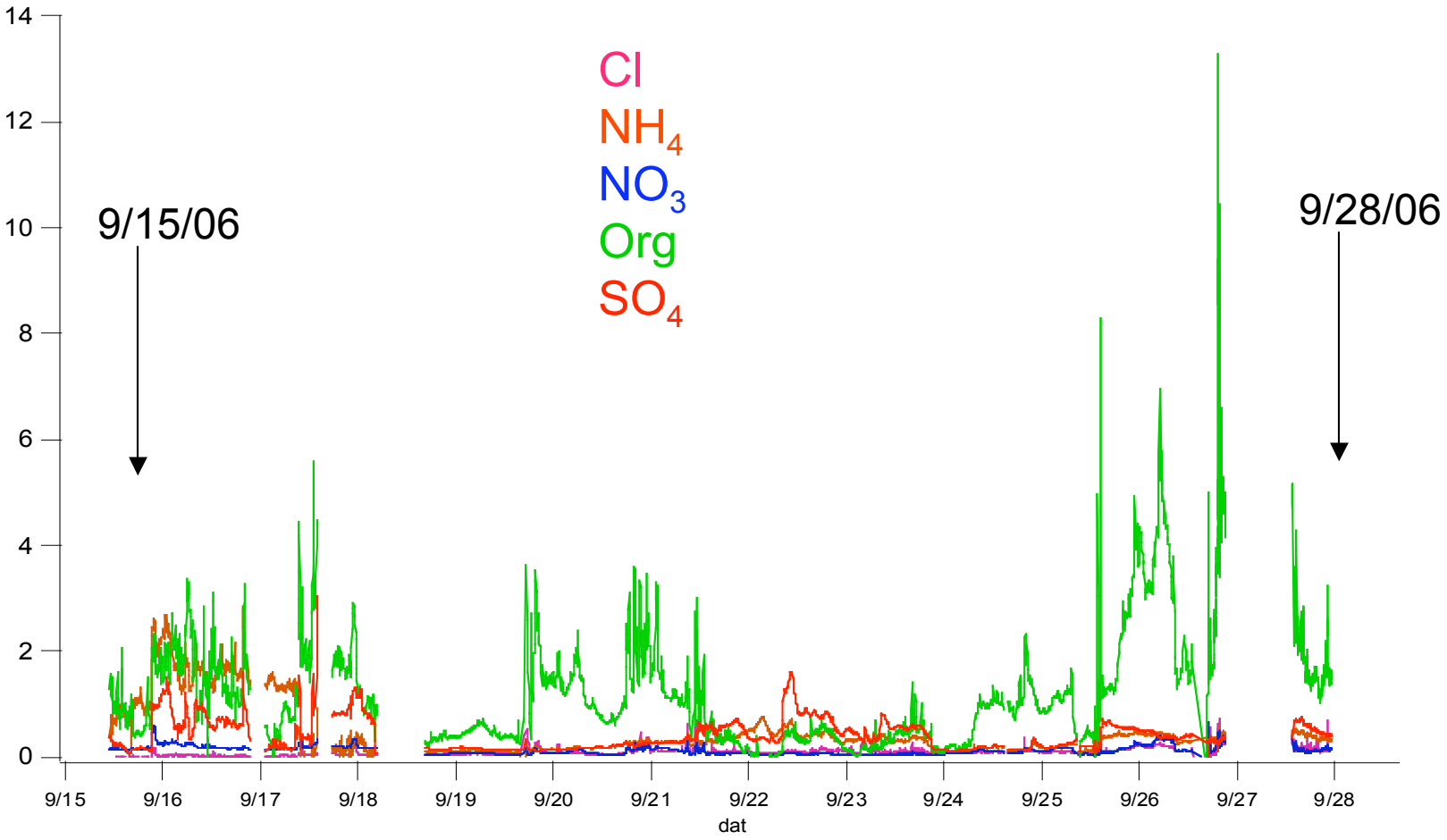
Preliminary PTR-MS time series

Sept. 13

Sept. 28



Preliminary AMS time series

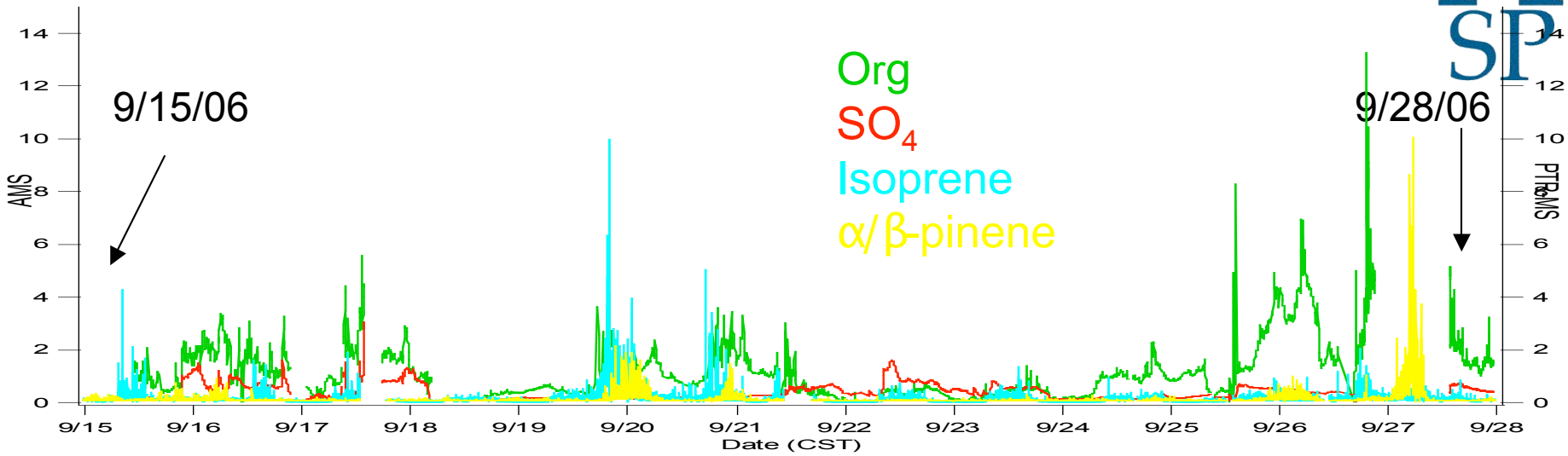


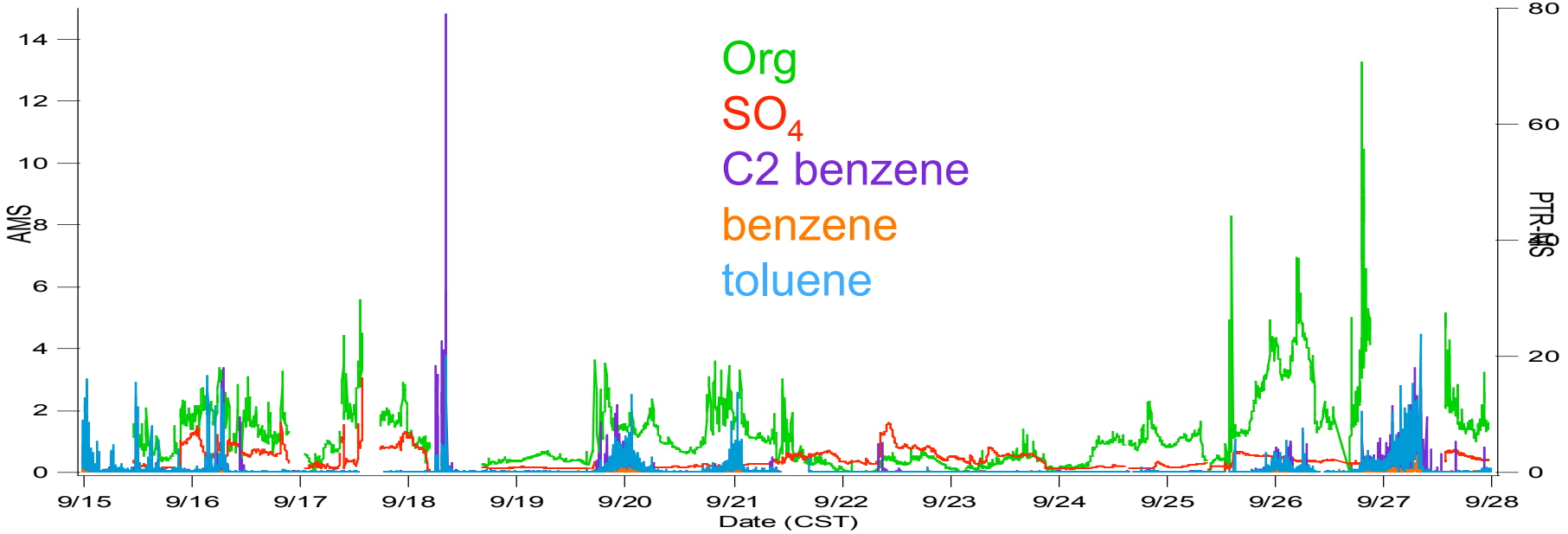
Corrections/calibrations (CE, IE, and size) are not yet incorporated, the mass loading concentrations here are only plotted here to show trend

Identified sampling periods of interest

- Based on high mixing ratios of hydrocarbons and aromatic compounds from PTR-MS, periods of interests may include:
  - 9/13/06 - 9/15/06
  - 9/16/06
  - 9/18/06
  - 9/20/06 – 9/21/06
  - 9/25/06
  - 9/26/06 – 9/28/06
- Based on high aerosol mass loading from AMS
  - 9/15/06
  - 9/16/06
  - 9/17/06 – 9/18/06
  - late 9/19/06 – early 9/21/06
  - 9/24/06 - 9/25/06
  - 9/26/06 – 9/28/06

Comparison between AMS and PTR-MS





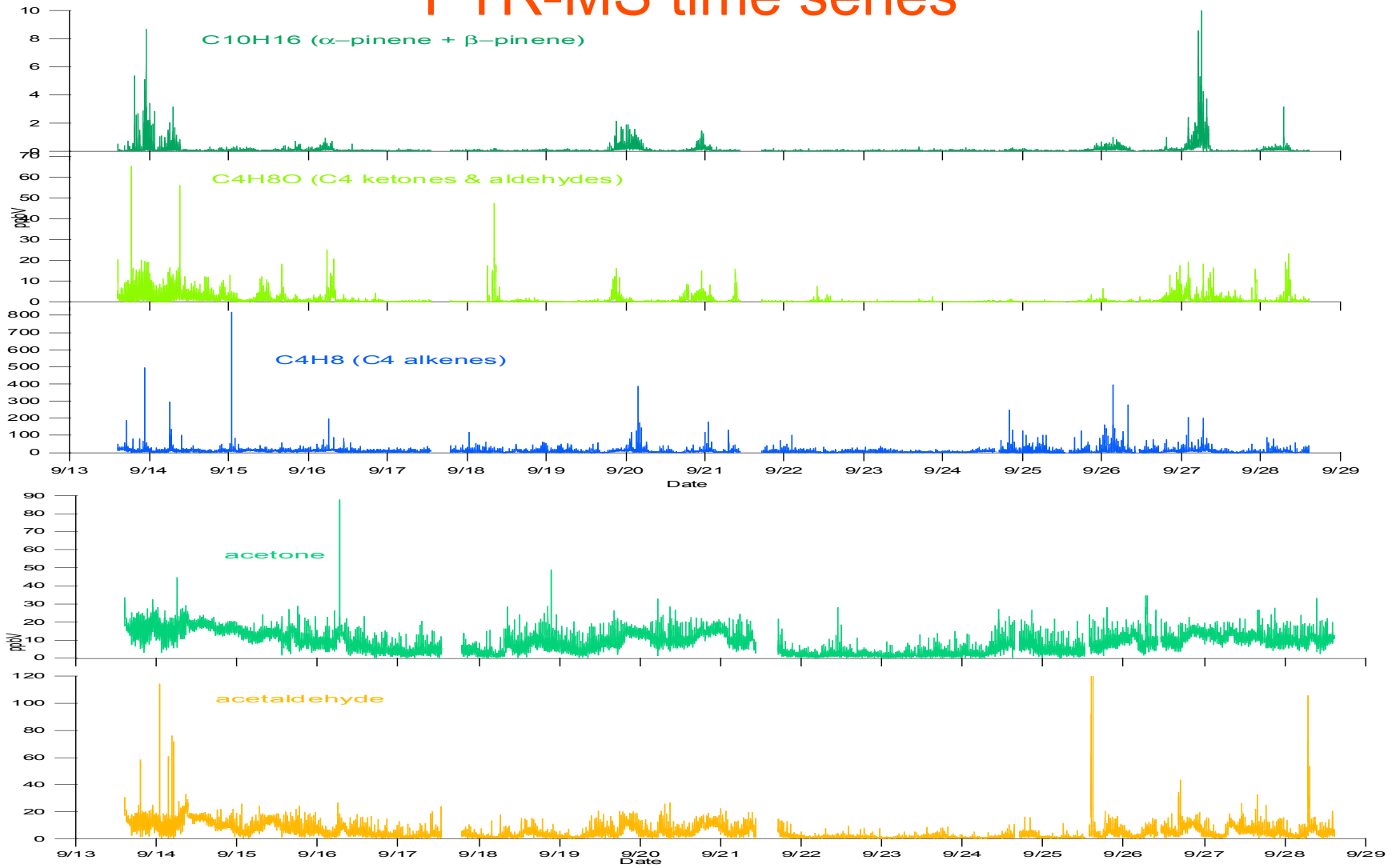
Identify Interesting Periods/Episodes

- Based on met data and preliminary back trajectory analysis
  - Southerly, northerly, southeasterly, northeasterly are the predominant wind directions
  - High mixing ratios of trace gases and VOCs were observed under northerly or northeasterly wind flows; (where are the sources?) and southeasterly (influence from ship channel)
- Based on preliminary TCEQ trace gas measurements including O_3, NO/NO_2/NOx, NOy etc. lead to the same interesting sampling periods
- Based on PTR-MS and AMS measurements
- Based on from comparison between PTR-MS and AMS

Future Plan

- Data analyses
  - AMS and PTR-MS QA/QC
    - Finalize size resolved AMS speciation and full spectrum of PTR-MS
  - Prepare manuscript addressing the science questions and summarizing key observations
    - AMS
    - PTR-MS
    - TDMA
    - O_3, CO, NO/NO_2/NOx, and NOy etc.
  - In-depth analysis of selected periods
    - Comparison with other observations
    - Modeling
- Implications
  - SOA and VOC
  - Useful data set for process modeling

PTR-MS time series



Considering high mixing ratios of hydrocarbons and aromatic compounds, periods of interests may include:

• 9/13/06 - 9/15/06 9/16/06 9/18/06 9/20/06 – 9/21/06 9/25/06 9/26/06 – 9/28/06

PTR-MS and AMS Comparison

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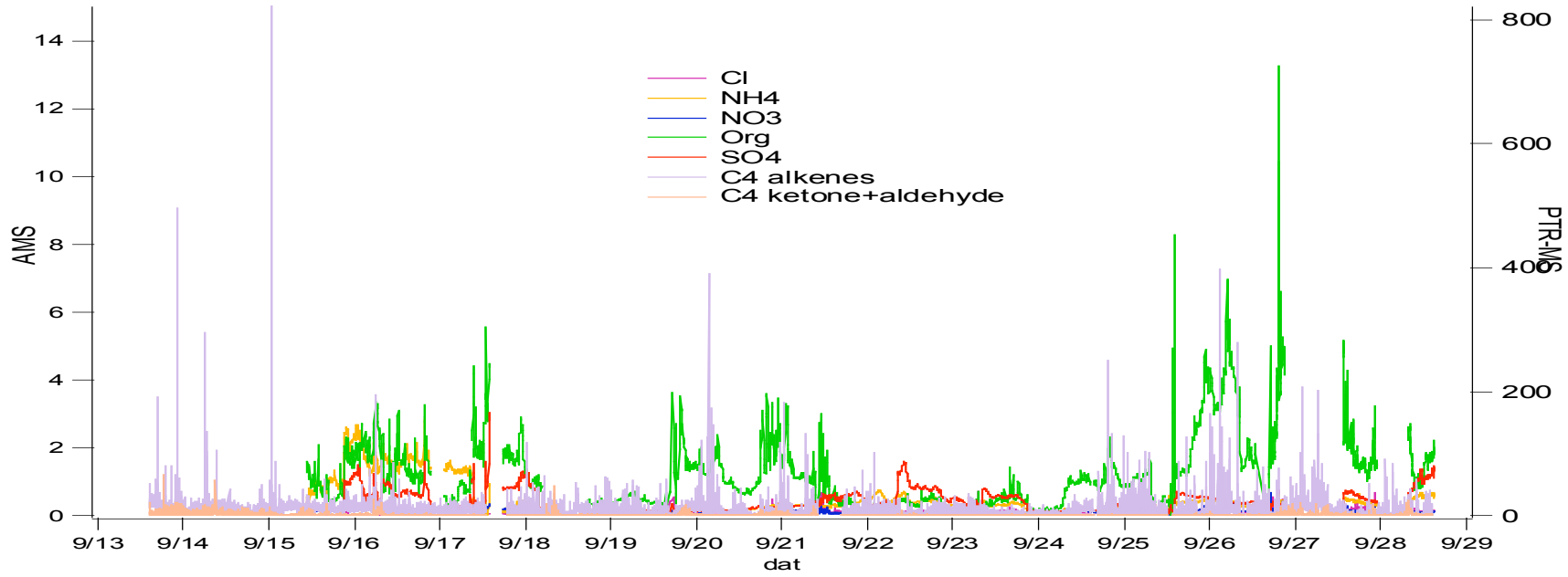
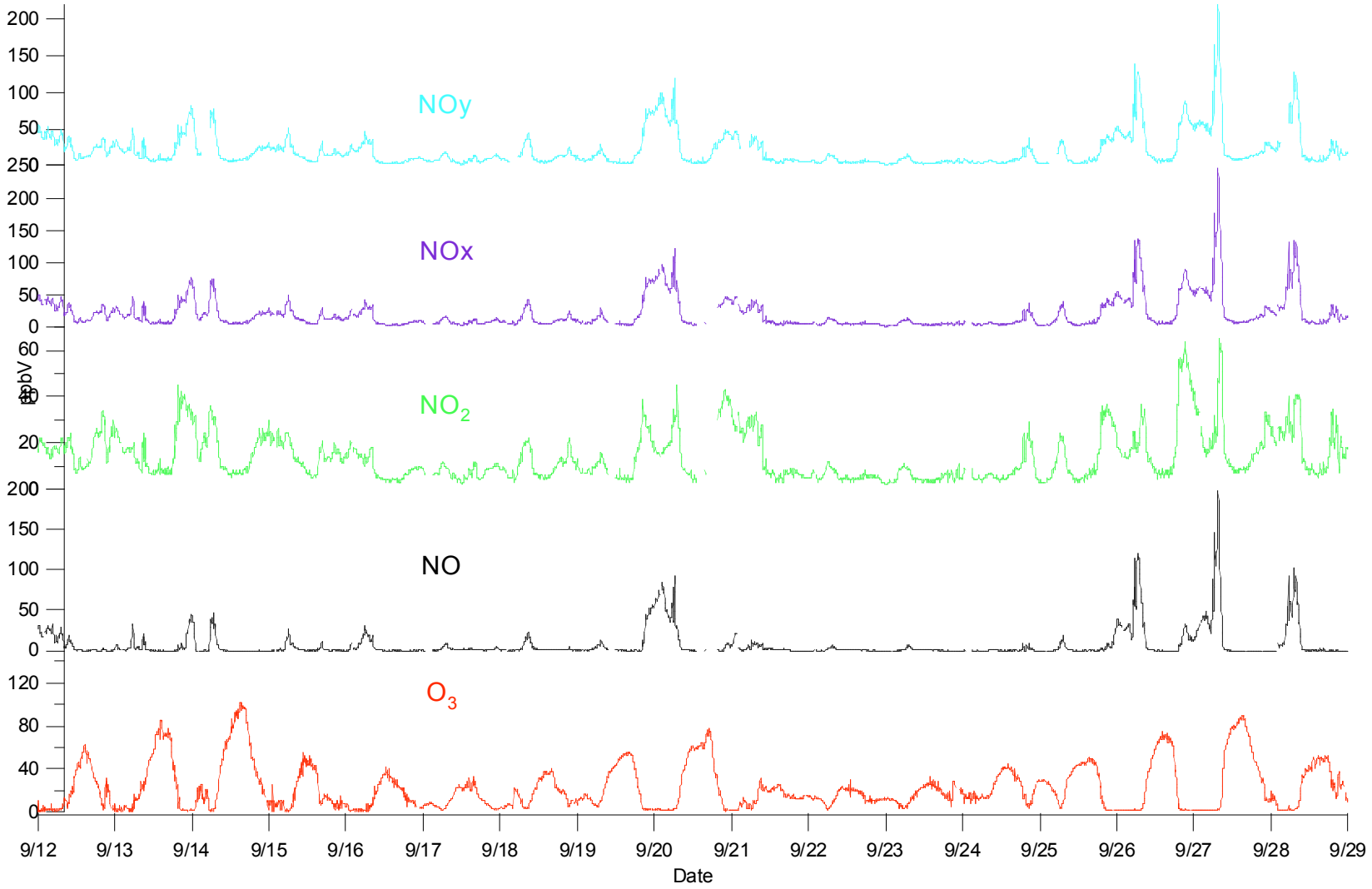
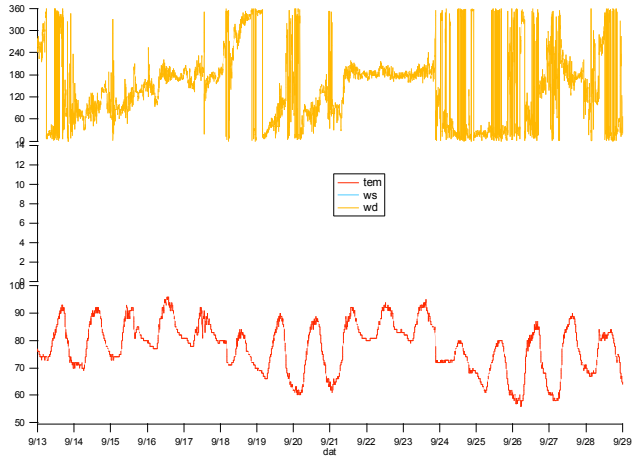


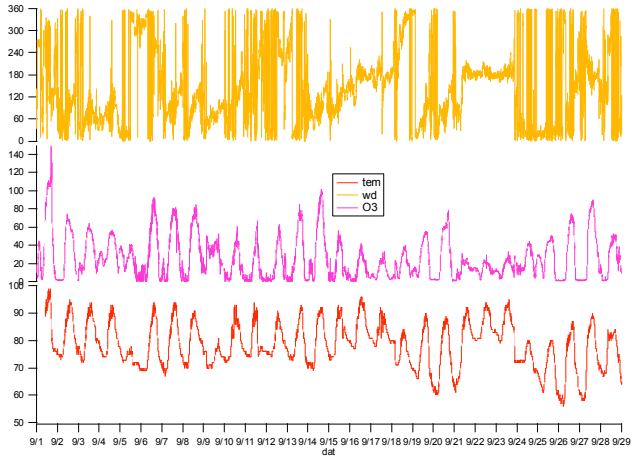
Trace gas time series



- Considering high mixing ratios of trace gases, periods of interests may include: 9/13/06 - 9/15/06; 9/16/06; 9/18/06; 9/20/06 – 9/21/06; 9/25/06; 9/26/06 – 9/28/06

Back up preliminary met data





Gas-to-particle and particle-to-gas conversion
schematic plot
VOCs and SOAs, what can we learn from Aldine

Acknowledgement

- Funding
  - DOE, ASP
  - PNNL, EMSL
  - HARC, TX
- People
  - PNNL: Victor Morris, Mathew Newburn, Nels Laulainen, Ruth Keefe, and Beverly Johnson
  - HARC: Alex Cuclius
  - TCEQ: Vince Torres, Jim Neece, Jim Thomas, Raj Nadkarni and many others